Research Note

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SUGGESTIONS FOR MANUFACTURE AND OPERATION OF A SIX-INCH INFILTROMETER RING

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Ring infiltrometers of various sizes and shapes have been used for many years in investigations of water intake capacities of soils as related to cover conditions and types, and land uses and treatments. Probably every group studying forest and range influences or making watershed surveys has used one or more types, and probably most groups have developed at least one of their own.1/

There is considerable difference of opinion concerning the value of the ring infiltrometer for detailed scientific measurements, but it is generally agreed that it is useful for demonstration purposes in showing the large differences in initial infiltration induced by various kinds and degrees of land use and treatment. It should not be assumed that results can be correlated with infiltration for actual rainfall. Rates obtained with the ring are generally much higher than would be obtained by natural rainfall on bare, unprotected soils. On soils well protected from beating raindrops by litter or other cover, rates obtained by the ring probably more nearly approach those for natural rainfall. However, it is also possible that important differences in rates between two conditions may not be apparent from a limited number of tests with the ring infiltrometer.

Interest in soil-water-land use relationships is growing. Doubtless many technicians need a simple means to demonstrate to themselves and to others the effects of proper and improper land use or practice upon the water that falls on the soil. Results obtained by the ring infiltrometer are indicative of these effects.

There are some real advantages to the adoption of uniform equipment and procedures within a region. The following suggestions are offered to encourage uniformity. They describe a sturdy ring and outline two methods of operation.

1/ NRM Forest & Range Experiment Station Research Note No. 76, "A tin can infiltrometer with improvised baffle" by A. B. Evanko, February 1950, describes one version of the ring infiltrometer.

EQUIPMENT

The ring itself can be made by rolling a 6 x 18.85-inch piece of 16-gauge black iron sheet to form a cylinder 6 inches in diameter. The cylinder should be butt-welded along the side and sharpened at one end by bevelling from the outside. A stick 6 to 10 inches long should be nailed to the center of a circular disk of tin about $5\frac{1}{2}$ inches in diameter to make a baffle. At the beginning of operation the baffle is set inside the ring to break the impact of the water. Other refinements such as painting inside rings and attaching inside rulers or graduated scales can be provided if desired. Total cost should not exceed $2.00 or $3.00.

SELECTION AND PREPARATION OF SITE

The exact spot selected for the test should be as representative as possible of conditions to be tested. For obvious reasons rocks, large surface roots, brush and other major obstructions must be avoided.

Most large infiltrometers apply water in the form of drops to simulate rain. In such cases, litter and humus are left in place so that their importance in breaking the impact of drops is not disregarded. However, with the ring type device where a baffle is used and a quantity of water is applied instantaneously, more consistent records are obtained if litter, humus and vegetal matter are removed from the plot before the ring is set in place. Removal of organic matter also simplifies installation and operation. Living plants should be clipped at the ground level without disturbing the soil.

PLACING THE RING

The beveled edge of the ring must be forced into the soil deeply enough (usually about one inch) to prevent unusual lateral water movement and with the least possible disturbance to the area within the ring. On slopes, the ring should be kept vertical rather than at right angles to the ground surface.

In fairly loose soil the ring can be pushed to the desired depth by hand, especially if a knife is used to probe down along the edge. A slight twisting acting is helpful but excessive twisting causes large fractures in the soil structure which will nullify the results.

If the ring cannot be forced into the ground by hand, it should be driven by placing a short length of 2 x 4-inch timber across the top of the ring and using a hammer, mallet or another piece of 2 x 4-inch timber for pounding the crosspiece. Here, again, a knife is helpful in opening a groove for the beveled edge. Care must be used to minimize soil disturbance.

When the ring is in place, soil can be tamped around the outside to help prevent leakage of the water.

SUGGESTIONS FOR OPERATION

Under normal conditions an area will have a high initial infiltration which gradually decreases as water continues to be available over a period of time. In many instances the initial infiltration is important, as when a watershed is subjected to an intense rainstorm of short duration. The long-time infiltration rate is of paramount concern when prolonged wetting occurs such as happens during major snow-melt periods.

The first of the following two methods of operation provides a measure of initial infiltration but may be affected to a major degree by the soil disturbance caused by the placing of the ring. The second method discounts some of the high initial rate, particularly that due to disturbance of the soil, in that a short pre-wetting period is recommended.

(1) This simple method of operation is the mere measurement of time required for a given volume of water to soak into the ground. The baffle is placed on the soil inside the ring to protect the soil from impact when the water is applied. A measured volume of water (one pint equals one inch in depth within the ring) is added, the baffle is removed and the elapsed time, between introduction of the water and its disappearance in the ring, is noted. This method is fast, simple, and well adapted for show-me trips where qualitative or rough comparisons rather than definite quantitative results are satisfactory.

(2) The second operational method is a little more time-consuming and requires more care and attention, but the results are more significant. A six-inch ruler is clipped vertically inside the ring with the zero end approximately at the soil surface on the uphill side. The baffle is placed in the ring as before and removed after about a pint of water has been added. Water is then added continuously to keep the level in the ring at the 1-inch mark on the ruler. At the end of a 5-minute period with the water at the 1-inch mark, no more water should be added. Elapsed time is recorded for the disappearance of each $\frac{1}{4}$ inch as measured by the ruler until the water level reaches the zero end of the ruler. A type of infiltration curve of water depths over time can be plotted from these four or five observations and compared with curves obtained on other sites. It is recommended that records of results be kept showing the following information: location of plot, cover type and condition, character of litter and humus, land use, soil character, aspect, slope, evidence of erosion, date, observer, and infiltration data. Over a period of time an extremely valuable file of information can be accumulated.

The Northern Rocky Mountain Forest and Range Experiment Station would appreciate receiving copies of data and descriptive material for tests made in accordance with the second method of operation.